# SANDSTONE PETROLOGY AND GEOCHEMISTRY OF THE TURPAN BASIN, (NW CHINA): IMPLICATIONS FOR THE TECTONIC EVOLUTION OF A CONTINENTAL BASIN

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**ABSTRACT**: The evolution of the Turpan basin (NW China) from the Permian to the Tertiary was reconstructed from sandstone petrology and geochemistry. The sandstones are mostly feldspathic litharenite and litharenite, and were deposited mainly in fluvial and lacustrine environments. Sandstone samples show large variations in the contents of quartz and lithic fragments. A general increase in compositional maturity is observed from the Permian to the Tertiary. In particular, quartz content is only 11% in the Permian, increases to 27% in the Triassic, 35% in the Lower Jurassic, 36% in the Upper Jurassic, and more than 47% in the Cretaceous and Tertiary. The geochemistry of sandstones also varies with time. Late Permian sandstones have lower $SiO_2$ (67.48%), and higher $Fe_2O_3$ (4.87%) and MgO (1.75%) values, whereas Triassic and Jurassic samples show high $SiO_2$ (74.15%, 77.5% respectively) and low $Fe_2O_3$ (4.06%, 2.8%) and MgO (0.95%, 0.79%) contents. In the Cretaceous and Tertiary, $Fe_2O_3$ and MgO contents increased again. $K_2O$, $Na_2O$, and $Al_2O_3$ also vary considerably within the study site.

The tectonic evolution of the basin can be subdivided into three stages from petrologic and geochemical data: the first stage covers the Permian; the second stage the Triassic and Jurassic, and the third stage the Cretaceous and Tertiary. There are two large discontinuities in sandstone composition among these three stages. These discontinuities signify the influence of collision and convergence of the Tarim block at the end of the Permian, and the Gangdise block between the Jurassic and the Cretaceous, with the Eurasian Plate.

The source-rock regions of the basin varied with time. In Permian, Triassic, and Jurassic time, the paleo--Jueluotage Shan Mountains were the dominant source region for the Turpan basin, while in the Cretaceous and Tertiary, the paleo--Bogda Shan Mountains were an important source region. In the Tertiary and later, the Bogda Shan Mountains continued to be strongly uplifted during the collision of the Indian Plate with the Eurasian Plate and were the dominant source region. The trace-element ratios Eu/Eu*, $Gd_n/Yb_n$, La/Yb, and La/Th (subscript n refers to chondrite-normalized values) show that the source rocks of the sedimentary rocks were derived from upper continental crust.

The data from the Turpan basin show that combined petrologic and geochemical analysis of sandstone suites can be used to track changes in the sediment supply from adjacent areas if (1) a long-term record of the basin fill is available; (2) the source signal is preserved by “proximal” depositional conditions; and (3) diagenetic alteration of sediments is limited. Provenance-derived variations in sandstone compositions are therefore a key in unraveling regional tectonic histories.